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GENERIC JOINTWARE

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Using **standard taper jointware**, you can connect glassware without rubber stoppers, corks, or tubing. Pieces are joined by glass connections built into the apparatus (Fig. 17). They are manufactured in standard sizes, and you'll probably use $\text{F } 19/22$.

The symbol F means **standard taper**. The first number is the size of the joint at the widest point, in millimeters. The second number is the length of the joint, in millimeters. This is simple enough. Unfortunately, life is not all that simple, except for the mind that thought up this next devious little trick.

STOPPERS WITH ONLY ONE NUMBER

Sounds crazy, no? But with a very little imagination, and even less thought, grave problems can arise from confusing the two. Look at Fig. 18, which shows all glass stoppers are not alike. Interchanging these two leads to **leaking joints** through which your **graded** product can escape. Also, the $\text{F } 19/22$ stopper is much more expensive than the $\text{F } 19$ stopper, and you may *have to pay money* to get the correct one when you check out at the end of the course. Please note the emphasis in those last two sentences. I appeal to your better nature and common sense. So, take some time to check these things out.

As you can see from Fig. 18, that single number is the width of the stopper at its top. There is no mention of the length, and you can see that it is too short. The $\text{F } 19$ stopper *does not* fit the $\text{F } 19/22$ joint. Only the $\text{F } 19/22$ stopper can fit the $\text{F } 19/22$ joint. Single-number stoppers are commonly

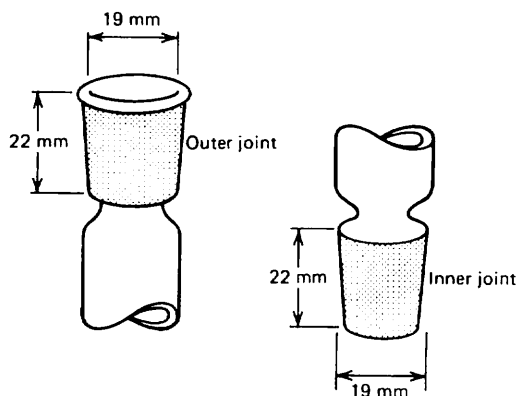


Fig. 17 Standard taper joints ($\text{F } 19/22$).

used with volumetric flasks. Again, they will leak or stick if you put them in a double-number joint.

With these delightful words of warning, we continue the saga of coping with ground-glass jointware. Figure 19 shows some of the more familiar pieces of jointware you may encounter in your travels. They may not be so familiar to you now, but give it time. After a semester or so, you'll be good friends, go to reactions together, maybe take in a good synthesis. Real fun stuff!

These pieces of jointware are the more common pieces that I've seen used in the laboratory. You may or may not have *all* the pieces shown in Fig. 19. Nor will they necessarily be called exactly by the names given here. The point is *find out* what each piece is, and *make sure* that it is in good condition *before* you sign your life away for it.

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ANOTHER EPISODE OF LOVE OF LABORATORY

"And that's \$28.46 you owe us for the separatory funnel."

"But it was broken when I got it!"

"Should've reported it then."

"The guy at the next bench said it was only a two-dollar powder funnel and not to worry and the line at the stockroom was long anyway, and . . . and . . . anyway the stem was only cracked a little ...and it worked O.K. all year long.Nobody said anything...."

"Sorry."

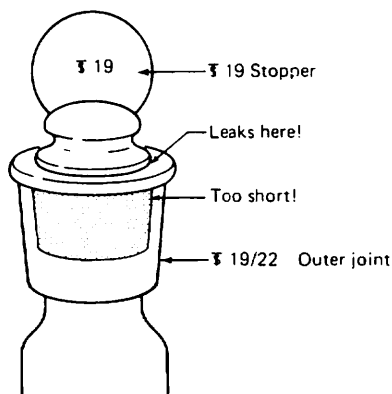


Fig. 18 A 329 nonstandard stopper in a 319/22 standard taper joint.

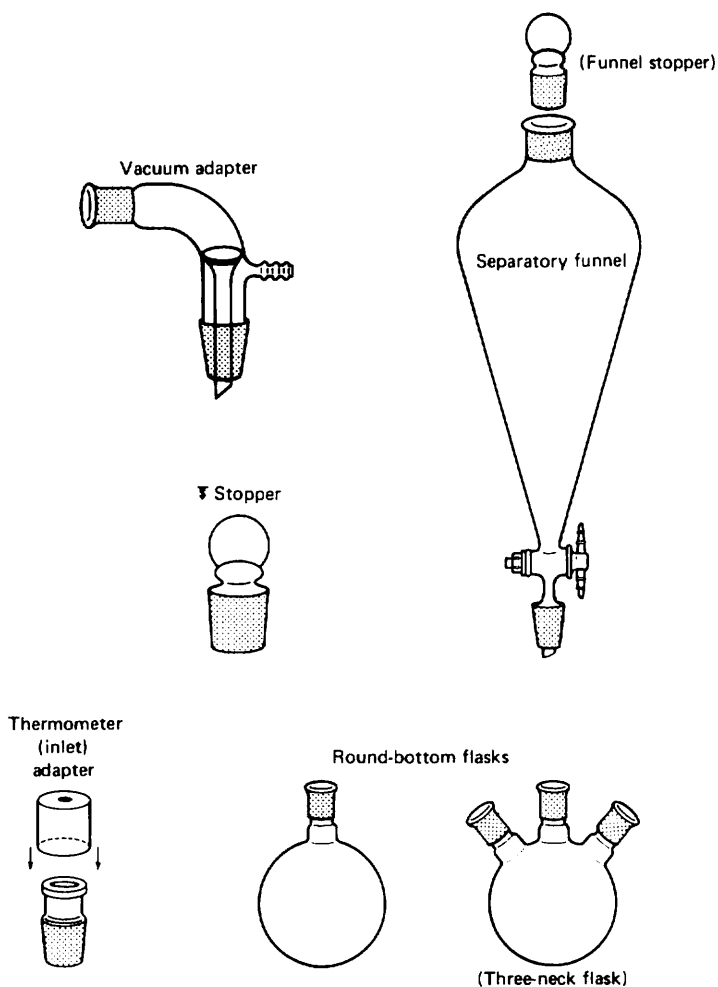


Fig. 19 Some jointware.

Tales like these are commonplace, and ignorance is no excuse. Don't rely on expert testimony from the person at the next bench. He may be more confused than you are. And equipment that is "slightly cracked" is much like a person who is "slightly dead." There is no in-between. If you are told that you *must* work with damaged equipment because there is no replacement available, you would do well to get it in writing.

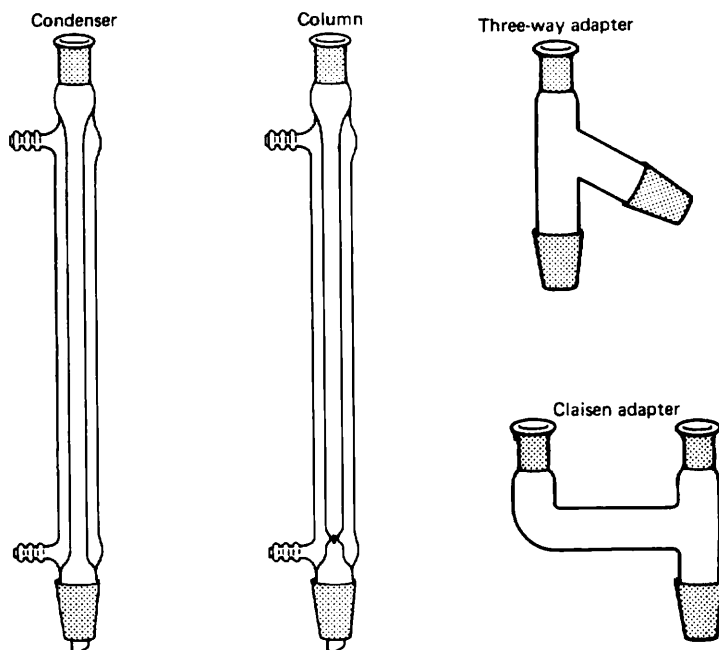


Fig. 19 (continued) Some jointware.

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HALL OF BLUNDERS AND THINGS NOT QUITE RIGHT

Round-Bottom Flasks

Round-bottom (R.B.) jointware flasks are so round and innocent looking that you would never suspect they can turn on you in an instant.

1. **Star cracks.** A little-talked-about phenomenon that turns an ordinary R.B. flask into a potentially explosive monster. Stress, whether prolonged heating in one spot or indiscriminate trouncing upon hard surfaces, can cause a flask to develop a **star crack** (Fig. 20) on its backside. Sometimes they are hard to see, but if overlooked, the flask can split asunder at the next lab.
2. **Heating a flask.** Since they are cold-blooded creatures, flasks show more of their unusual behavior while being heated. The behavior is usually unpleasant if certain precautions are not taken. In addition to star cracks, various states of disrepair can occur, leaving you with a benchtop to clean. Both humane and cruel heat treatment of flasks

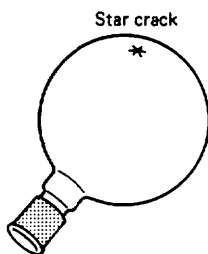


Fig. 20 R.B. flask with star crack.

will be covered in Chapter 18, "Sources of Heat," which is on the SPCG (Society for the Prevention of Cruelty to Glassware) recommended readings list.

Columns and Condensers

A word about **distilling columns** and **condensers**:

Different!

Use the **condenser** as is for **distillation** and **reflux** (see Chapter 20, "Distillation," and Chapter 22, "Reflux"). You can use the *column with or without column packing* (bits of metal or glass or ceramic or stainless-steel sponge—whatever)! That's why the column is wider and it has *projections* at the end (Fig. 21). These projections help hold up the column packing if you use any packing at all (see Fig. 104).

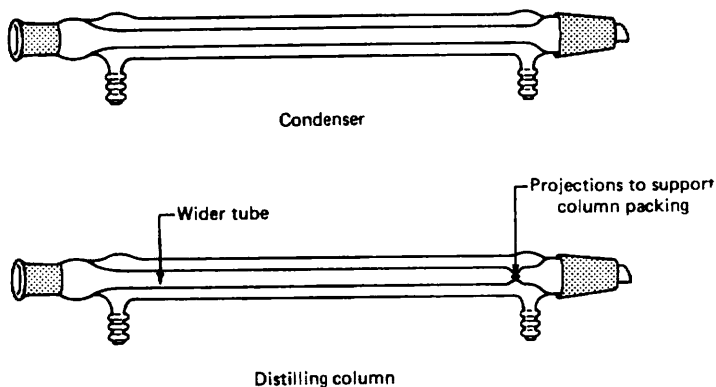


Fig. 21 Distilling column versus condenser.

If you jam column packing into the skinny condenser, the packing may never come out again! Using a condenser for a packed column is bad form and can lower your esteem or grade, whichever comes first.

You might use the column as a condenser.
Never use the condenser as a packed column!

The Adapter with Lots of Names

Figure 22 shows the one place where joint and nonjoint apparatus meet. There are two parts: a rubber cap with a hole in it and a glass body. Think of the rubber cap as a rubber stopper through which you can insert thermometers, inlet adapters, drying tubes, and so on.

CAUTION! Do not force. You might snap the part you're trying to insert. Handle both pieces through a cloth; lubricate (water) and then insert carefully.

The rubber cap fits over the **nonjoint** end of the glass body. The other end is a **ground glass joint** and *fits only other glass joints*. The rubber cap should neither crumble in your hands nor need a 10-ton press to bend it. If the cap is shot, get a new one. Let's have none of these corks, rubber stoppers, chewing gum, or any other type of plain vanilla adapter you may have hiding in the drawer.

And remember: Not only thermometers, but **anything** that resembles a glass tube can fit in here! This includes unlikely items such as **drying tubes** (they have an outlet tube) and even a **funnel stem** (you may have to couple the stem to a smaller glass tube if the stem is too fat).

The imaginative arrangements shown in Fig. 23 are acceptable.

Forgetting the Glass

Look, the Corning people went to a lot of trouble to turn out a piece of glass (Fig. 24) that fits perfectly in *both* a glass joint *and* a rubber adapter, *so use it!*

Inserting Adapter Upside Down

This one (Fig. 25) is really ingenious. If you're tempted in this direction, go sit in the corner and repeat over and over,

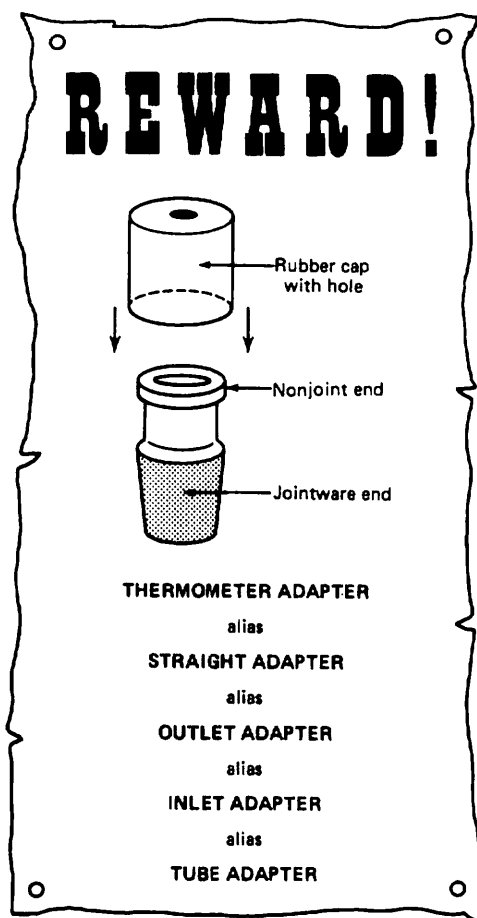


Fig. 22 Thermometer adapter.

"Only glass joints fit glass joints."

Inserting Adapter Upside Down *Sans* Glass

I don't know whether to relate this problem (Fig. 26) to glass forgetting, or upside-downness, since both are involved. Help me out. If I don't see you trying to use an adapter upside down without the glass, I won't have to make such a decision. So, don't do it.

GREASING THE JOINTS

In all my time as an instructor, I've never had my students go overboard on greasing the joints, and they never got them stuck. Just lucky, I guess. Some instructors, however, use grease with a passion and raise the roof over it. The entire concept of greasing joints is not as slippery as it may seem.

To Grease or Not to Grease

Generally, you'll grease joints on two occasions. One, when doing vacuum work to make a tight seal that can be undone; the other, doing reactions with a strong base that can etch the joints. Normally, you don't have to protect the joints during acid or neutral reactions.

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SOCIALLY ACCEPTABLE THINGS TO DO WITH
THE ADAPTOR WITH LOTS OF NAMES

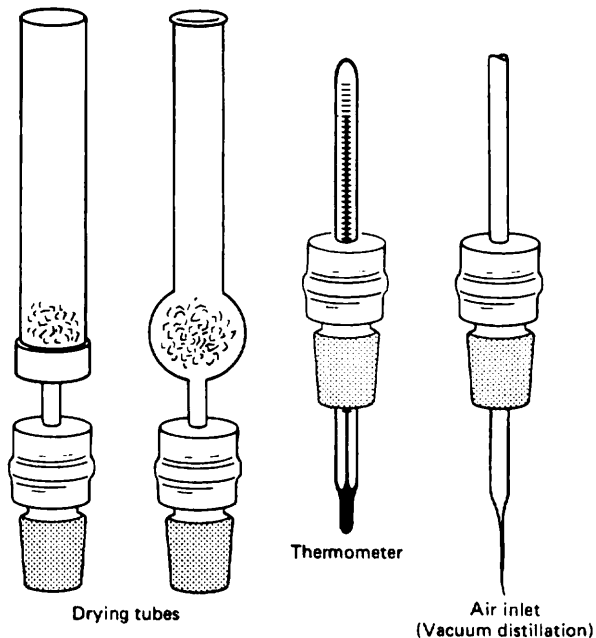


Fig. 23 Unusual, yet proper, uses of the adaptor with lots of names.

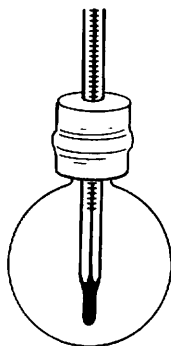


Fig. 24 The glassless glass adapter.

Preparation of the Joints

Chances are you've inherited a set of jointware coated with 47 semesters of grease. First wipe off any grease with a towel. Then soak a rag in any hydrocarbon solvent (hexane, ligroin, petroleum ether—and *no flames*, these burn like gasoline) and wipe the joint again. Wash off any remaining grease with a strong soap solution. You may have to repeat the hydrocarbon-soap treatments to get a clean, grease-free joint.

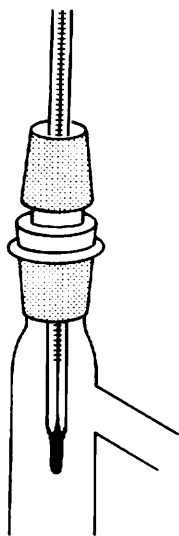


Fig. 25 The adapter stands on its head.

Into the Grease Pit (Fig. 27)

First, use only enough grease to do the job! Spread it thinly along the upper part of the joints, only. Push the joints together with a twisting motion. The joint should turn clear from one third to one half of the way down the joint. *At no time should the entire joint clear!* This means you have *too much grease* and you must start back at *Preparation of the Joints*.

Don't interrupt the clear band around the joint. This is called **uneven greasing** and will cause you headaches later on.

STORING STUFF AND STICKING STOPPERS

At the end of a grueling lab session, you're naturally anxious to leave. The reaction mixture is sitting in the joint flask, all through reacting for the day, waiting in anticipation for the next lab. You put the correct glass stopper in the flask, clean up, and leave.

The next time, the stopper is stuck!

Stuck but good! And you can probably kiss your flask, stopper, product, and grade goodbye!

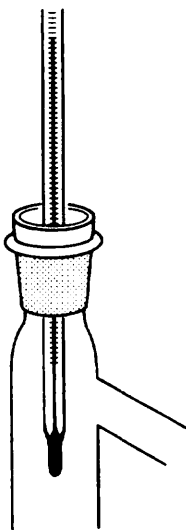


Fig. 26 The adapter on its head, without the head.

Frozen!

Some material has gotten into the glass joint seal, dried out, and cemented the flask shut. There are few good cures but several excellent preventive medicines.

Corks!

Yes, corks, old-fashioned, non-stick-in-the-joint corks.

If the material you have to store *does not attack cork*, this is the cheapest, cleanest method of closing off a flask.

A well-greased glass stopper *can* be used for materials that attack cork, but *only* if the stopper has a good coating of stopcock grease. Unfortunately, this grease can get into your product.

Do not use rubber stoppers!

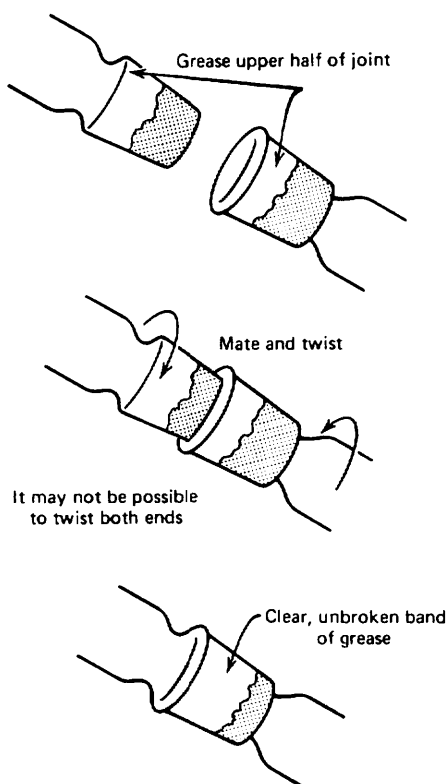


Fig. 27 Greasing ground glass joints.

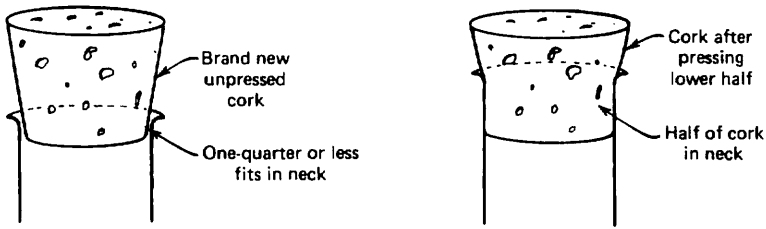


Fig. 28 Corking a vessel.

Organic liquids can make rubber stoppers swell up like beach balls. The rubber dissolves and ruins your product, and the stopper won't come out either. Ever.

The point is

Dismantle all ground glass joints before you leave!

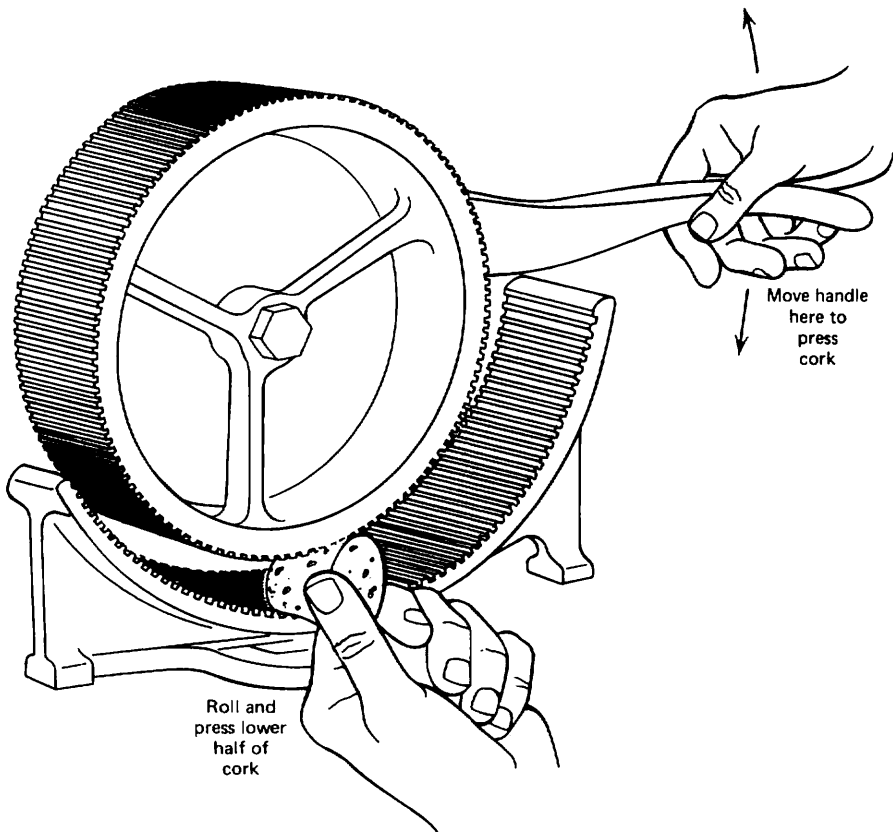


Fig. 29 A wall-mounted cork press.

CORKING A VESSEL

If winemakers corked their bottles like some people cork their flasks, there'd be few oenophiles and we'd probably judge good years for salad dressings rather than wines. You don't just take a new cork and stick it down into the neck of the flask, vial, or what have you. You must press the cork first. Then as it expands, it makes a very good seal and doesn't pop off.

A brand new cork, **before pressing or rolling**, should fit only about one quarter of the way into the neck of the flask or vial. Then you roll the lower half of the cork on your *clean* benchtop to soften and press the small end. *Now* stopper your container. The cork will slowly expand a bit and make a very tight seal (Fig. 28).

THE CORK PRESS

Rather than rolling the cork on the benchtop, you might have the use of a **cork press**. You put the small end of the cork into the curved jaws of the press, and when you push the lever up and down, the grooved wheel rolls and mashes the cork at the same time (Fig. 29). Mind your fingers!